

REMARKS

Claims 1, 4-12, and 17-26 are pending in the application. Claims 1, 18, and 20-26 have been amended. Further, claims 4-12 have been withdrawn pursuant to a restriction requirement. The applicants respectfully request entry of the amendment presented herein in order to place their pending claims in condition for allowance. No new matter has been added by the amendment.

Rejection Under 35 U.S.C. § 102

Claims 1, 17, and 20-26 have been rejected over Mueller et al. This rejection is believed overcome in view of the amendment of claims 1 and 20 together with the following remarks.

To further clarify the claimed subject matter, the applicants have amended claims 1, 18, and 20 to recite that the claimed etching agent or etching solution is an aqueous anisotropic copper etching agent. The applicants respectfully assert that the recitation of an aqueous anisotropic copper etching agent recites the claimed subject matter from a definitional perspective rather than from a functional perspective. In short, claims 1, 18, and 20 have been amended to clarify the subject matter of these claims as to what the etching agent is, rather than what it does. Accordingly, the applicants respectfully assert that the claims do not recite an intended use but rather positively identify the type of claimed etching agent.

As previously argued by the applicants, Mueller et al. does not suggest or disclose the applicants claimed invention at least because Mueller et al. disclose a slurry composition for use in a chemical-mechanical-polishing process. In contrast, claim 1, as amended, recites an aqueous anisotropic copper etching agent. The applicants respectfully assert that claim 1, as amended, is directed to a particular type of etching agent. The claimed etching agent is an anisotropic copper etching agent. The applicants describe in their specification that their etching agent is formulated such that the lateral etching of copper is minimized when etching a copper layer having an overlying masking pattern. (Specification, pgs. 4-5). The applicants assert that those

skilled in the art recognize that anisotropic etching agents etch a film in the vertical direction much faster than in the horizontal or lateral direction. The etching characteristics of the anisotropic etch enables the etch to faithfully reproduce a mask pattern overlying the film with minimal loss of line width. In contrast, an isotropic etch etches a film in vertical and horizontal directions at nearly the same rate, which causes undercutting of the mask pattern.

In contrast to the applicants' claimed anisotropic etching agent, the slurry of Mueller et al. is used in conjunction with an abrasive polishing mechanism for the removal of a metal layer to obtain a relatively flat, smooth surface. Accordingly, the slurry of Mueller et al. is a fundamentally different composition than the applicants' claimed anisotropic copper etching agent.

To further distinguish their claimed invention, the applicants have amended claim 1 to recite that the acetic acid is present in a range of 10 wt.% to 75 wt.% relative to the potassium hydrogen peroxomonosulfate. The applicants respectfully assert that Mueller et al. does not suggest or disclose the claimed concentration relationship.

Claim 17 depends from claim 1 and recites that the etching agent selectively etches copper. In their specification, the applicants describe the selective etching action of their etching agent. For example, Table 1 on page 42 of the applicants' specification shows the selective etching action of their claimed etching agent. As shown in Table 1 and described in Example 4, the copper layer was etched at a substantially higher rate than the underlying metal films. Accordingly, the applicants respectfully assert that claim 17 further distinguishes their claimed etching agent over the slurry disclosed by Mueller et al.

Claim 17 has also been amended to recite that the acetic acid is present in a range of 10 wt.% to 75 wt.% relative to the potassium hydrogen peroxomonosulfate. The applicants respectfully assert that Mueller et al. does not suggest or disclose the claimed concentration relationship.

Claim 20 has been amended to recite an aqueous anisotropic copper etching solution. The solution is formulated to anisotropically etch a copper layer having a masking pattern thereon. The applicants respectfully assert that the polishing slurry

disclosed by Mueller et al. does not suggest or disclose the applicants claimed aqueous anisotropic copper etching solution. The applicants respectfully assert that their claimed composition is an anisotropic etching agent. As previously argued by the applicants in their Response dated September 14, 2004, the anisotropic etching agent produces a copper etch profile having substantially vertically sidewalls. The applicants respectfully assert that such a result is not possible with the slurry composition disclosed by Mueller et al. Accordingly, the applicants respectfully assert that their claimed anisotropic etching composition substantially differs from the slurry disclosed by Mueller et al.

The applicants respectfully disagree with the assertion at page 4 of the instant Office Action that Mueller et al. inherently teaches the applicants' claimed composition. The applicants respectfully assert that the inherent disclosure of a prior art reference cannot be ascertained through hindsight reconstruction in view of the applicants' claims. The applicants respectfully assert that inherency must be established through the teaching of the reference itself. *The Continental Can Co. U.S.A. v. Montano Co.*, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). Accordingly, the alleged inherent teaching of Mueller et al. has not been established.

Further, the applicants respectfully assert that the functional limitations in the applicants' claims must be given full force and effect. The applicants respectfully assert that the functional aspect of the claimed acetic acid as a wetting agent is integrally coupled with the etching action of potassium hydrogen peroxomonosulfate. A functional limitation must be evaluated and considered for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used. (M.P.E.P. § 2173.05(g)). Further, functional limitations in the applicants' claims cannot be established by elements in a reference that perform a different function. See *RCA Corp. v. Applied Digital Data Sys., Inc.*, 221 USPQ 385, 389 (n.5) (Fed. Cir. 1984).

Claim 20 recites that the acetic acid continuously wets exposed surfaces of the copper layer and the potassium hydrogen peroxomonosulfate uniformly etches the copper layer such that the layer is etched to substantially the same dimensions as the

masking pattern. The applicants respectfully assert that these functional limitations distinguish claims 1 and 20 and their dependent claims over Mueller et al.

Claim 20 has also been amended to recite that the acetic acid is present in a range of 10 wt.% to 75 wt.% relative to the potassium hydrogen peroxomonosulfate. The applicants respectfully assert that Mueller et al. does not suggest or disclose the claimed concentration relationship.

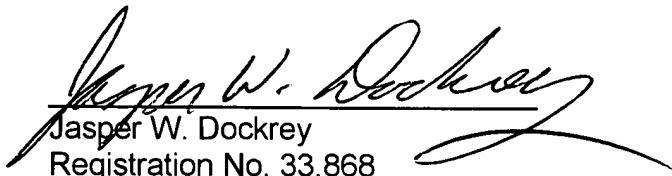
Rejection Under 35 U.S.C. § 103(a)

Claims 1 and 17 have been rejected over Condra et al. in view of Kubotera et al. This rejection is believed overcome in view of the amendment of claim 1 together with the following remarks. The applicants respectfully assert that neither Condra et al. nor Kubotera et al. suggest or disclose the claimed anisotropic copper etching agent having the claimed concentration relationship.

Claims 18-19 have been rejected over Okinaka. The applicants respectfully assert that Okinaka does not suggest or disclose the applicants claimed anisotropic copper etching agent. The applicants' remarks in their previous response pertaining to Okinaka are incorporated herein. In addition to higher potassium hydrogen peroxomonosulfate concentration recited in claim 18 than is suggested by Okinaka, the etching solution disclosed by Okinaka is not anisotropic. In describing the disclosed etching solution, Okinaka states that “[t]oo high a concentration of alkali leads to excessive attack on the aluminum metal before undercutting.” (Col. 4, ll. 13-15). The “undercutting” described by Okinaka is the signature of an isotropic etch.

The applicants have made novel and non-obvious contributions to the art of anisotropic copper etching formulations. The claims at issue are believed to distinguish over the cited references and to be in condition for allowance. Accordingly, such allowance is now earnestly requested.

Respectfully submitted,



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